

# Investigation

## 1

## Enlarging and Reducing Shapes

**I**n this investigation, you will explore how some properties of a shape change when the shape is enlarged or reduced.

### 1.1

### Solving a Mystery

**T**he Mystery Club at P.I. Middle School meets monthly. Members watch videos, discuss novels, play “whodunit” games, and talk about real-life mysteries. One day, a member announces that the school is having a contest. A teacher in disguise will appear a few minutes at school each day for a week. Any student can pay \$1 for a guess at the identity of the mystery teacher. The student with the first correct guess wins a prize.

The club decides to enter the contest together. Each member brings a camera to school in hopes of getting a picture of the mystery teacher.

*How might a photograph help in identifying the mystery teacher?*



## Problem 1.1 Introduction to Similarity

One of Daphne's photos looks like the picture below. Daphne has a copy of the *P.I. Monthly* magazine shown in the picture. The *P.I. Monthly* magazine is 10 inches high. She thinks she can use the magazine and the picture to estimate the teacher's height.

- A.** What do you think Daphne has in mind? Use this information and the picture to estimate the teacher's height. Explain your reasoning.

The adviser of the Mystery Club says that the picture is similar to the actual scene.

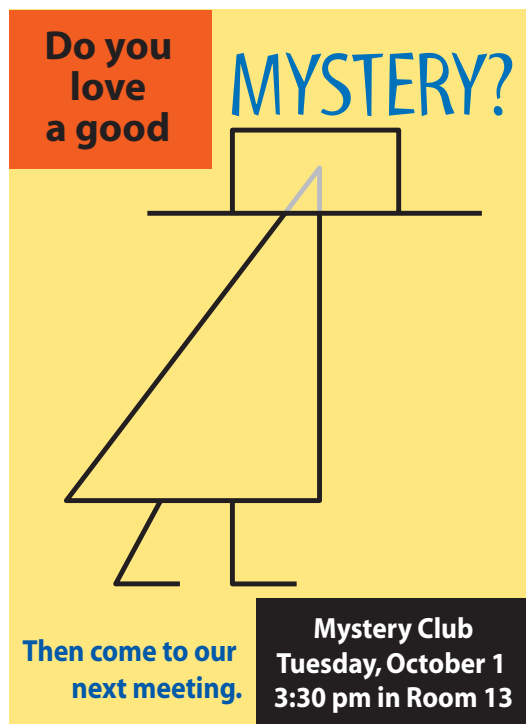
- B.** What do you suppose the adviser means by *similar*? Is it different from saying that two students in your class are similar?



**ACE** Homework starts on page 12.

## 1.2 Stretching a Figure

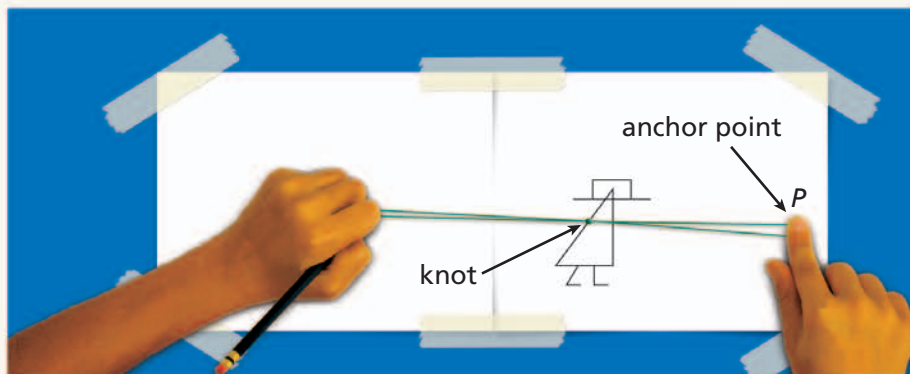
**M**ichelle, Daphne, and Mukesh are the officers of the Mystery Club. Mukesh designs this flier to attract new members.



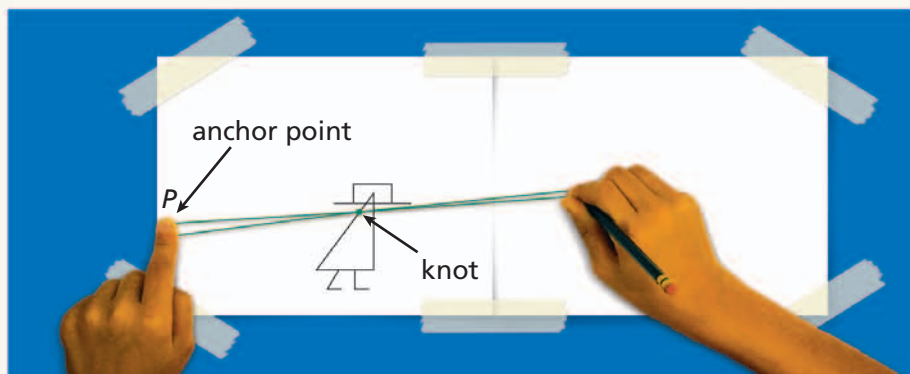
Daphne wants to make a large poster to publicize the next meeting. She wants to redraw the club's logo, "Super Sleuth," in a larger size. Michelle shows her a clever way to enlarge the figure by using rubber bands.

## Instructions for Stretching a Figure

1. Make a “two-band stretcher” by tying the ends of two identical rubber bands together. The rubber bands should be the same width and length. Bands about 3 inches long work well.
2. Take the sheet with the figure you want to enlarge and tape it to your desk. Next to it, tape a blank sheet of paper. If you are right-handed, put the blank sheet on the right. If you are left-handed, put it on the left (see the diagram below).
3. With your finger, hold down one end of the rubber-band stretcher on point *P*. Point *P* is called the anchor point. It must stay in the same spot.
4. Put a pencil in the other end of the stretcher. Stretch the rubber bands with your pencil until the knot is on the outline of your picture.
5. Guide the knot around the original picture while your pencil traces out a new picture. (Don't allow any slack in the rubber bands.) The new drawing is called the **image** of the original.



Left-handed setup



Right-handed setup

## Problem 1.2 Comparing Similar Figures

Use the rubber-band method to enlarge the figure on the Mystery Club flier. Draw as carefully as you can, so you will be able to compare the size and shape of the image to the size and shape of the original figure.

**A.** Tell how the original figure and the image are alike and how they are different. Compare these features:

- the general shapes of the two figures
- the lengths of the line segments in the hats and bodies
- the areas and perimeters of the hats and bodies
- the angles in the hats and bodies

Explain each comparison you make. For example, rather than simply saying that two lengths are different, tell which lengths you are comparing and explain how they differ.

**B.** Use your rubber-band stretcher to enlarge another simple figure, such as a circle or a square. Compare the general shapes, lengths, areas, perimeters, and angles of the original figure and the image.

**ACE** Homework starts on page 12.

### Did You Know?

Measurement is used in police work all the time. For example, some stores with cameras place a spot on the wall 6 feet from the floor. When a person standing near the wall is filmed, it is easier to estimate the person's height. Investigators take measurements of tire marks at the scene of auto accidents to help them estimate the speed of the vehicles involved. Photographs and molds of footprints help the police determine the shoe size, type of shoe, and the weight of the person who made the prints.

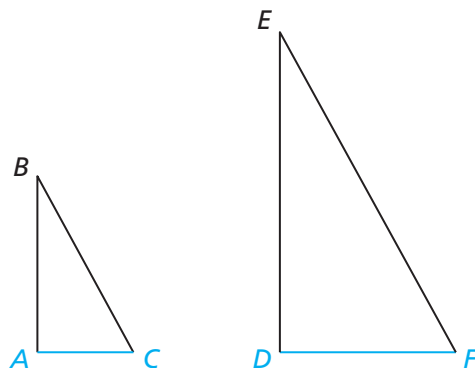


For: Information about police work.  
Web Code: ane-9031

## 1.3

## Scaling Up and Down

In studying similar figures, we need to compare their sides and angles. In order to compare the right parts, we use the terms **corresponding sides** and **corresponding angles**. Each side in one figure has a corresponding side in the other figure. Also, each angle has a corresponding angle. The corresponding angles and sides of the triangles are given.

**Corresponding sides**

$AC$  and  $DF$

$AB$  and  $DE$

$BC$  and  $EF$

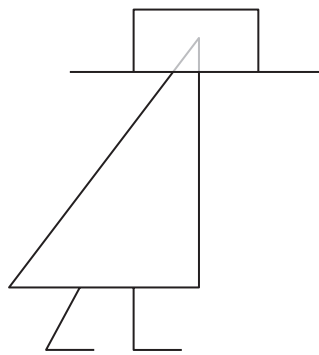
**Corresponding angles**

$A$  and  $D$

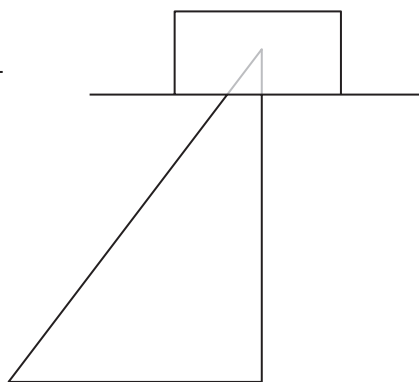
$B$  and  $E$

$C$  and  $F$

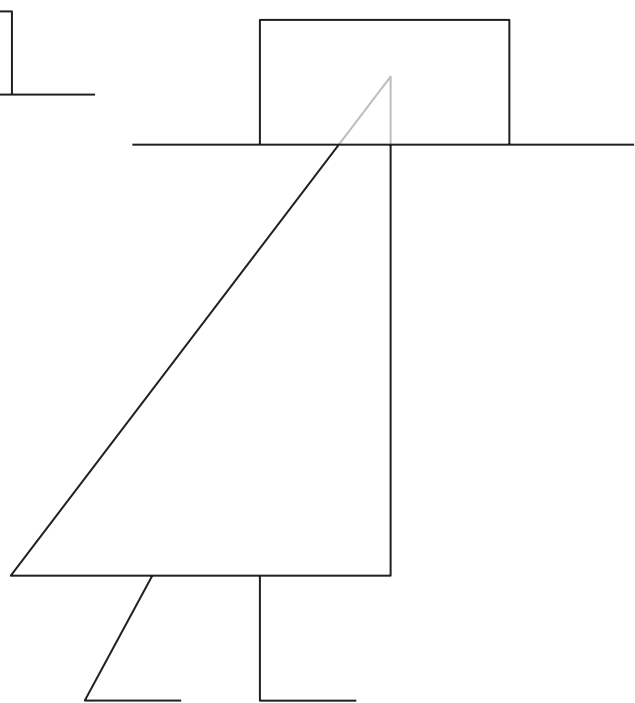
Daphne thinks the rubber-band method is clever, but she believes the school copier can make more accurate copies in a greater variety of sizes. She makes a copy with the size factor set at 75%. Then, she makes a copy with a setting of 150%. The results are shown on the next page.



Copied  
at 75%



Original design



Copied at 150%

### Problem 1.3 Corresponding Sides and Angles

- A.** For each copy, tell how the side lengths compare to the corresponding side lengths in the original design.
- B.** For each copy, tell how the angle measures compare to the corresponding angle measures in the original design.
- C.** Describe how the perimeter of the triangle in each copy compares to the perimeter of the triangle in the original design.
- D.** Describe how the area of the triangle in each copy compares to the area of the triangle in the original design.
- E.** How do the relationships in the size comparisons you made in Questions A–D relate to the copier size factors used?

**ACE** Homework starts on page 12.